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Lastro-Bravo XB, Hubbard MC, Garrod GD, Tolon-Becerra A. What drives farmers' participation in EU agri-environmental schemes? Results from a qualitative meta-analysis. *Environmental Science & Policy* 2015, 54, 1-9.

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DOI link to article:

http://dx.doi.org/10.1016/j.envsci.2015.06.002

Date deposited:

23/06/2015

Embargo release date:

20 June 2016

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What drives farmers' participation in EU agri-environmental schemes?: Results from a qualitative meta-analysis

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Abstract

A better understanding of why EU farmers choose to join agri-environmental schemes (AESs) is vital to help policy makers design programmes that would be more attractive to participants. This paper identifies the key factors influencing farmers' participation in AESs through a qualitative meta-analysis of papers published in peer-reviewed journals between 2000 and 2013. A range of empirical studies that explored factors influencing farmers' willingness to participate in such schemes were selected and systematically analysed. The meta-analysis reveals several key drivers for participation in AESs including fair payments, lower household dependency on agricultural incomes, age and education levels, the presence of a successor and the ability to make progressive rather than step changes to agricultural activities. Of particular importance is the finding that the design of agri-environmental policy is not the only relevant factor influencing uptake but other policies which impact on the farm household and the rural community can also encourage or discourage participation in an AES.

Keywords: agri-environmental schemes; qualitative meta-analysis; systematic review; farmers' participation; European Union.

Highlights:
We examine farmers' willingness to participate in agri-environmental schemes.
We perform a qualitative meta-analysis on adoption factors of AES.
Economic factors were found to play a key role on farmers' willingness to participate.
Social capital promotion will also increase willingness to adopt AES.

1. Introduction

Over the last 40 years, the development of agri-environmental policy in the European Union (EU) has been 'tightly bound' to the development and reform of the Common Agricultural Policy (CAP) (Gorton *et al.*, 2009). In the 1980s, agri-environment schemes (AESs) were a separate policy domain operating alongside CAP measures, and their implementation was optional for Member States (Ducos *et al.*, 2009). Their role was strengthened in the 1990s when they were made compulsory as an "accompanying measure", following MacSharry's CAP reform, and significantly reinforced (as a policy in itself) under the Agenda 2000 reforms, when provisions for AESs were introduced into EU rural development policy (Axis 2 of CAP Pillar 2) (European Commission, 2005; Ducos *et al.*, 2009; European Court of Auditors, 2011).

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Typically, AESs are implemented through a contract made between a public body in the Member States and a beneficiary (farmer or land manager) for a given period, usually five to ten years (European Court of Auditors, 2011). The resulting agreements require farmers to modify their farming practices in exchange for a per-hectare payment (Espinosa-Goded *et al*., 2010). Farmers commit to implement one or more of the following farming practices on their land: organic farming; integrated production; other extensification of farming systems (input reduction and extensification of livestock farming); crop rotation, maintenance of set-aside areas; action to prevent or reduce soil erosion; genetic resources preservation; biodiversity conservation and enhancement actions; upkeep of the landscape, conservation of historical features on agricultural land and public access; and, water-related actions such as buffer strips, field margins, wetland management and reduction strategies (European Commission, 2005; European Court of Auditors, 2011).

The level of payment made to the farmer depends on the activities undertaken and the agricultural capacity of the land and is calculated by taking into account income forgone and the additional costs associated with the requirements of the scheme (Espinosa-Goded *et al*., 2010). Over the period 2007-2013, EU Member States were allocated over €22 billion to cover AES payments (European Court of Auditors, 2011). These high levels of public expenditure have motivated a large number of studies that seek to evaluate and improve the performance of AESs (Espinosa-Goded *et al*., 2010). However, to the best of authors' knowledge no systematic review has been conducted to better understand why EU farmers are participating in these schemes.

Against this background, the objective of this paper is to identify the key factors that influence EU farmers' willingness to participate in an AES by conducting a systematic qualitative meta-analysis of empirical studies carried out between 2000 and 2013. By doing so, the paper aims to contribute to a better understanding of why farmers choose to join agri-environment schemes which in turn should help policy makers to design and implement programmes/schemes that would be more attractive to potential participants. Moreover, such programmes may deliver positive externalities beyond the benefits to farmers and the environment *per se*. The paper is structured as follows: Section 2 presents a literature review of farmers' behaviour related to the voluntary aspects of AESs. Section 3 describes the methodology and section 4 discusses findings based on the meta-analysis, with some conclusions reported in the final section.

2. The importance of the voluntary nature of AESs on farmers' participation

According to Council Regulation (EC) No 1698/2005, the purpose of AES payments is to *"further encourage farmers and other land managers to serve society as a whole by introducing or continuing to apply agricultural production methods compatible with the protection and improvement of the environment, the landscape and its features, natural resources, the soil and genetic diversity"* (European Court of Auditors, 2011). Therefore farmers and landowners have been identified as the agents who will deliver these particular CAP goals and it is expected that they will modify their behaviour to achieve the desired environmental changes (Falconer, 2000).

A basic principle of AESs is that participation is voluntary (European Commission, 2005; European Court of Auditors, 2011). Thus, farmers' willingness to participate in an AES is central to achieving policy objectives (Wilson, 1996; Espinosa-Goded *et al*., 2010). Clearly, adequate participation is a key indicator of success, and the closer AESs get to achieving their target levels of participation, the greater the probability that they will accomplish their aims (Wilson and Hart, 2000). In addition, the voluntary nature of the schemes tends to encourage farmers to adopt a cooperative and positive attitude towards the environment (European

Commission, 2005). Current evidence, however, seems to suggest that the voluntary nature of AESs may not necessarily be effective in inducing permanent changes to farmers' attitudes and behaviour with respect to sustainable environmental management (Burton *et al*., 2008; Burton and Paragahawewa, 2011).

Farmers who voluntarily participate in AESs are compensated for adopting farming practices designed to achieve environmental benefits. Such practices tend to be more restrictive than those required to qualify for support payments under Pillar 1 of the CAP (e.g. direct payments and cross-compliance) (Ducos *et al*., 2009). In addition, payment levels have to be set so that they are sufficiently attractive to farmers when compared to the actions required to comply with the scheme and their associated costs, any income forgone, and related administrative costs while at the same time avoiding over-compensation (European Commission, 2005; European Court of Auditors, 2011).

Research into why farmers choose to participate in AESs should be a key tool for agri-environmental policy development (Wilson and Hart, 2000; Falconer, 2000; Guillem and Barnes, 2013). Early work on factors influencing farmers to adopt AESs, focused on socio-economic and structural characteristics, while some more recent work on farmers' behaviour has been based on principles of social psychology and notions of social capital (Beedell and Rehman, 2000, Falconer, 2000; Defrancesco *et al*., 2008). It has been argued that conservation management cannot be ensured by adequate payment levels alone, and that for agri-environmental policies to be successful, participants must achieve some level of cultural understanding around the need for management (Wynne-Jones, 2013). This recognises that farmers, like most people, may not simply prioritise financial gain above all other factors but may gain equal or greater utility from other actions that may benefit the environment or society (Wynne-Jones, 2013). Emery and Franks (2012) suggest that taking better account of farmers' preferences should be the main approach to enhancing cultural sustainability and maintaining the long-term trust of farmers enrolled in schemes, a view that is endorsed by Whittingham (2011).

The main factors identified in the literature as influencing farmers' willingness to participate in an AES can be classified into the following categories: financial incentives (Wilson and Hart, 2000; Ruto and Garrod, 2009); the fit between scheme prescriptions and farming systems (Wynn *et al*., 2001; Sattler and Nagel, 2010; Wilson and Hart, 2000); farmers' characteristics, attitudes, and preferences (Wilson, 1996; Wynn *et al*., 2001; Sattler and Nagel, 2010; Wilson and Hart, 2000); the underlying financial, geographic and regulatory context (Sattler and Nagel, 2010); and farm characteristics (Wilson and Hart, 2000; Wynn *et al*., 2001).

3. Methodology

This study is based on a systematic review of the literature on factors that affect EU farmers' willingness to participate in AESs, which then forms the basis of a qualitative meta-analysis. More specifically, the analysis concentrates on those studies using binary logit or probit models to investigate the factors underlying farmers' willingness to participate in such schemes. The criteria for determining the inclusion of a study in the meta-analysis are: (1) studies that analysed agri-environmental measures; (2) studies that were geographically restricted to the Europe Union; (3) studies of factors affecting farmers' willingness to participate in an AES based on the empirical analysis of primary data; and (4) studies that developed a logit or probit model of the decision to participate in such a scheme.

Qualitative meta-analysis was selected as the approach for this study as it permits a more comprehensive understanding of the findings from a diverse set of studies, allowing them to be synthesised into one explanatory interpretative end product, not only aggregating the

findings but also interpreting them (Paterson *et al.*, 2001). This technique is useful for assessing the causality in findings across the studies included in the review (Onwuegbuzie *et al.*, 2012). Based on this premise, a group of empirical studies that explored factors influencing farmers' willingness to participate in AES were systematically selected and analysed. Similarities and differences across the studies were reviewed and compared to allow connections to be made across selected key research themes. The resulting analysis identified several key drivers for farmers' participation in AESs.

Here the qualitative meta-analysis is underpinned by a focus on studies that use a common analytical approach to investigating farmers' participation in AESs. Logit and probit models are commonly used in qualitative data analysis for estimating the probability that an event occurs or not by predicting a binary dependent outcome from a set of independent variables. The use of these binary dependent variable models is a common characteristic of the empirical studies reviewed here and in this research the relevant dependent variable is whether or not a farmer decides to participate in an AES.

The overall analysis consists of five major steps: (1) a literature search on AESs across the EU; (2) the identification of empirical studies where preferences and attitudes towards AESs are examined; (3) the selection of studies that use a logit or probit model to explore farmers' willingness to participate in an AES; (4) the identification of factors influencing farmers' willingness to participate; and (5) a qualitative meta-analysis of the selected studies. The period covered is 2000 to 2013, and the focus is on papers written in English.

The first step was conducted through keyword searches within two frequently-used scholar online databases, *i.e.* Web of Knowledge and Scopus, using individual keywords "agri-environmental* programme*", "agri-environmental* scheme*", "agri-environmental* scheme*", "agri-environmental* stewardship *" combined then with "European Union" and "CAP" (employing the Boolean search operator "AND"). The year 2000 was set up as the starting point for the literature search, as the year when the Agenda 2000 reforms began to be implemented. The adoption of the first Rural Development Regulation, *i.e.* the creation of the second Pillar of the CAP, represented a turning point in terms of environmental enhancement and was seen by many as the most significant feature of the Agenda 2000 reforms (Lowe *et al.*, 2002). As a result 415 articles were included in the initial database. From this any articles relating to farmers' preferences and attitudes towards AESs in the European Union were selected. Hence, those articles based on studies outside the EU were eliminated from the database. This reduced the initial database to 58 articles, from which only those that applied a logit or probit model to empirical data were finally selected. Hence, 10 papers were identified that satisfied the four stated criteria (Table 1).

These papers were all based on data from sample surveys performed mainly in the EU15 member states, with the exception of the Czech Republic (studies 1, 3 and 4 in Table 1). While all of these studies describe and analyse factors affecting farmers' willingness to adopt an AES, they differ in the choice of variables included in their models.

Table 1. Overview of the studies reviewed in the meta-analysis.

No	Author(s)	Countries	Sample	Sample year	Specific AES
1	Ducos *et al.* (2009)	Belgium, Czech Republic, Finland, France, Germany, Italy, Ireland, The Netherlands, United Kingdom	1799	2005	• Inclusion of fixed cost
2	Defrancesco *et al.* (2008)	Italy	139	2005-2006	• Low-input measures • Grassland conservation in the aquifer recharge belt

					• Grassland conservation in the Alps
3	Polman and Slangen (2008)	Belgium, Czech Republic, Finland, France, Italy, The Netherlands	990	2005	• Landscape management • Biodiversity protection • Restriction of intensive practices
4	Ruto and Garrod (2009)	Belgium, Czech Republic, Finland, France, Germany, Italy, Ireland, The Netherlands, United Kingdom	2262	2005	• Short-term contracts • Long-term contracts
5	Hynes and Garvey (2009)	Ireland	294	1995-2005	• Rural Environment Protection Scheme ○ Factors to join REPS ○ Factors to be in REPS
6	Mathijs (2003)	Belgium	36	2002	• Countryside Stewardship Schemes
7	Espinosa-Goded et al. (2010)	Spain	300	2008	• Nitrogen fixing crops in marginal dry-land areas
8	Capitanio et al. (2010)	Italy	4652	2009	• Supporting Competitiveness Scheme • Supporting Agri-environmental Schemes
9	Barreiro-Hurle et al. (2010)	Spain	300	2006	• Environmental fallow measure • Alternative crop in special protected areas
10	Peerlings, and Polman (2009)	Belgium, France, Finland, Italy, The Neherlands	848	2005	• Landscape management • Biodiversity protection • Restriction on intensive practices

Once the articles were selected, the identification of factors/variables affecting farmers' willingness to enrol in an AES was undertaken. More than 160 variables were collected from the selected studies. These variables were then classified into five major categories: (a) economic factors; (b) farm structure; (c) farmer characteristics; (d) farmers' attitudes towards AESs; and (e) social capital. While farmers' perceptions about the environment can play a significant role in the process of decision-making, their influence is argued to be limited because of the conceptual complexity of the broad environmental dimension and its relationship to financial, ecological and social aspects (Wilson and Hart, 2000; Guillem and Barnes, 2013).

Finally, a rigorous secondary qualitative analysis of the primary findings (qualitative meta-analysis) of the selected studies was performed. These primary qualitative findings (the factors/variables affecting farmers' willingness to enrol in an AES) were then formally combined for their synthesis, interpretive integration and discussion. Table 2 was constructed to provide a more comprehensive description of the relationship between the identified variables and the selected studies. Based on Table 2 data, an analytic process to identify the key factors influencing farmers' willingness to participate in AESs was implemented. The main findings of the qualitative meta-analysis are presented in the next section.

4. Drivers of farmers' participation

Variables in the economic factors category were mainly related to sources of income and enterprise type. Farm size, labour and specialisation were all included in the farm structure category. The farmers' characteristics category included age, education and opinions on the future of the farm. Variables that reflect farmers' attitudes and opinions about AESs and the environment were placed in the associated category.

The degree of social connectivity between farmers and AESs was taken into account in the final category. Recent studies have argued that fostering social capital may be a good driver for increasing farmers' willingness to participate in an AES (Burton *et al*., 2008). Furthermore, the greater the institutional credibility (especially when messages are complex) and personal trust (mainly in advisors), the more likely farmers are to adopt an AES (Sutherland *et al*., 2013).

Once the variables were grouped into subcategories, Table 2 was constructed. Variables with significant effects (positive and negative) on farmers' willingness to participate in an AES were identified. In addition, the specifications for each effect were included.

Table 2. Driving forces underlying farmers' willingness to adopt or not an AES identified in the literature.

	Paper No									
Factors/ variables	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Economic factors										
Income		x**[b]		x**[b,c]	x[a]	x**[b]			x**[b]	x**[b]
Tenure	x[a]	x*[d]		x*[e]				x[a]		
Farm labour	x[a]	x*[h],**[g]	x*[f]		x[a]	x*[i]		x*[f]**[g]		
Business criteria	x[k]	x*[k]**[l]				x[j]		x*[j]		
Farm structure										
Farm size	x[a]	x*[m]	x[a]	x*[m]	x*[m]	x[a]		x**[m]		x[a]
Location		x*[n]			x*[o]			x*[n]		
Farm specialization	x**[q,r]		x*[p,s]		x*[q]			x**[p,r]	x**[r]	x*[p,q,s]
Farmers' characteristics										
Education level (higher)	x[a]	x**	x[a]	x[a]		x*			x*	x*
Age (older)	x[a]	x*	x**	x*[c]	x**	x**		x**	x*	x**
Opinion on farm's future		x**[t,u]	x[a]	x**[c,t]		x[a]		x[a]	x**[u]	x[a]
Farmers' attitudes towards AES										
Previous experience	x*[v]	x*[v]		x*[w]	x*[v]				x*	
Payment (higher)		x*		x*			x*			
Measures implementation (easiness)		x*		x*[x]			x*[x]		x*	
Social Capital										
Technical advice and training		x*				x*	x*		x*	
Extension services	x[a]		x*[y]**[z]			x*[y,z]			x*[y,z]	x**[z]
Farming magazines		x*				x*				
Participation in organizations	x[a]		x*[α]**[β]			x[a]		x*[α]	x*[β]	x*[α]**[β]
Trust on government	x*	x*	x[a]							x*
Institutional policy		x*[γ]	x*[γ]	x*		x*[δ]				x*[γ]

* Significant positive effect on farmers' willingness to adopt an AES
** Significant negative effect on farmers' willingness to adopt an AES

[a] No significant effect
[b] High income for farming and total household income
[c] Long-terms contracts
[d] In low productive areas
[e] Low share of rented area for long-term contracts
[f] Off-farm labour
[g] Family labour
[p] Dairy farm systems
[q] Extensive systems (livestock and crops) and organic farms
[r] Total fixed assets, including machinery
[s] Changes in farm not related with AES
[t] Presence of successor
[u] Positive economic expectations
[v] on AESs

[h] Farmer as manager
[i] Part time work on the farm
[j] Business plan for development and the use of accountancy services
[k] Investment on machinery
[l] Investment on land
[m] Large farms for extensive systems
[n] Mountainous areas
[o] On areas with poor soils
[w] Environmentally-friendly farming practices / Environmental awareness
[x] Flexibility over what areas of the farm are entered into the AES
[y] Public extension
[z] Private extension, including financial entities
[α] Social organizations
[β] Agriculture-related organizations
[γ] Clear institutional design and stable policy
[δ] Use official relations to obtain a goal

4.1. Economic factors

Four of the 10 studies found that household income factors have significant effects on farmers' willingness to join an AES. Defrancesco *et al*. (2008), Barreiro-Hurle *et al.* (2010) and Mathijs (2003) each found that when farm income is a high proportion of total household income, this has a negative impact on the farmers' willingness to participate in an AES. This variable also was included by Ruto and Garrod (2009) when studying farmers' willingness to sign up for short or long-term AES contracts. A similar result was reported by Wilson and Hart (2000) in the case of farmers' willingness to adopt long-term contracts. Farmers with little or no off-farm income were less likely to join an AES, perhaps because the scheme involves the extensification of farm activities and this brings with it a risk of income reduction (Wossink and van Wenum, 2003). In this sense, higher levels of off-farm income positively affect farmers' willingness to participate in an AES, because this makes the decision to join less risky in terms of its potential impact on household income (Ruto and Garrod, 2009; Peerlings and Polman, 2009). Conversely, the more dependent the household was on on-farm income, the less likely it was to adopt an AES (Defrancesco *et al*., 2008). The negative relationship between dependence of farm income and farmers' willingness to adopt long-term contracts could be seen as an opportunity for policy makers to offer AESs as an additional means of achieving financial security for farms (Ruto and Garrod, 2009).

Defrancesco *et al*. (2008) and Ruto and Garrod (2009) all found that land tenure has a significant effect on farmers' willingness to adopt an AES. Both studies suggested that long-term contracts are less likely to be agreed if a high proportion of land on the farm is rented. This may be due to uncertainty about the future or because an agreement between landlords and tenants is required before such a contract is signed (Wilson and Hart, 2000).

The link between farm labour and farmers' participation has been analysed in several studies. Defrancesco et al. (2008) and Capitanio *et al*. (2011) found that the higher the level of family labour on the farm, the greater the marginal probability of non-participation in AESs. Moreover, Defrancesco *et al*. (2008) and Ruto and Garrod (2009) suggested that the extra labour required for administration is a constraint on farmers' participation in AESs. Polman and Slagen (2008) and Capitanio *et al*. (2011) highlighted the positive effect on the adoption of AESs that comes from having a large proportion of off-farm labour, especially where intensive practices are restricted and less labour is required. Similarly, Mathijs (2003) argued that employing a higher proportion of part-time workers also had a positive impact on willingness to participate in a scheme as this could again translate into cost savings if less labour is needed on the farm. In addition, the role of the farmer as manager was found to have a positive impact on her willingness to adopt an AES (Capitanio *et al*., 2011). Hynes and Garvey (2009), however, did not find any significant links between the use of family labour and farmers' willingness to join an AES.

Farmers' business planning has also been found to play a significant role in their willingness to join an AES. The existence of a business development plan and the use of accountancy services were both found to increase the likelihood of participation in an AES (Capitanio *et al.*, 2011). There were similar findings in cases where investments had been made in buildings and machinery to support extensive farming activities (Defrancesco *et al*., 2008; Ducos *et al*., 2009). However, where farmers adopted a business investment-oriented approach, focused on an increase in farm size, this had a negative impact on their willingness to join an AES (Defrancesco *et al.*, 2008). By contrast, Mathijs (2003) found that farmers who adopted a cost-saving strategy were more likely to adopt an AES.

4.2. Farm structure and other farm characteristics

Variables related to farm structure have also been identified as significant in explaining the decision to participate in an AES. According to Ruto and Garrod (2009) farmers with larger farms prefer long-term contracts. It was suggested that such farms are more likely to develop extensive systems or have land suitable for such systems, increasing the willingness of managers to adopt an AES (Hynes and Garvey, 2009). Similarly, Wilson and Hart (2000) found that EU farmers with farms larger than the regional average were more likely to participate in these schemes. Capitanio *et al.* (2011), however, noted that the managers of small farms were more interested in participating in AESs. In their studies, Ducos *et al.* (2009) and Mathijs (2003) found that farm area is not significant in the adoption of an AES.

Farm location can also play an important role in the farmers' willingness to adopt an AES. Location in upland areas has been shown to increase the probability of a scheme adoption (Capitanio *et al.*, 2011). Farms that are located in these areas and practice an extensive agriculture (mainly grasslands and a lower share of permanent crops and arable land) seem to fit in well with many conventional AESs (Defrancesco *et al.*, 2008). For example, in order to counter the decline in traditional farming in Alpine regions, Marini *et al.* (2011) proposed an AES that would compensate farmers for using less fertiliser and for maintaining the extensive management of steep meadows.

Hynes and Garvey (2009) noted that soil type is highly significant in the decision to adopt an AES, as farms with poor soils were more likely to join. If soil and climate characteristics are compatible with conservation measures, then, provided that measures do not increase costs, farmers' willingness to participate increases (Sattler and Nagel, 2010).

Several types of specialisation have been examined in the selected studies. It has been observed in some studies that livestock farmers seem to display a greater willingness to adopt an AES. Polman and Slagen (2008) and Peerlings and Polman (2009) found that specialist dairy farmers have a greater likelihood of being involved in landscape management and biodiversity protection schemes, but were less likely to consider adopting less intensive practices. Dupraz *et al.* (2003) suggested that livestock farmers would be less willing to enrol in an AES if they felt it would have negative effects on productivity potential and livestock density. By contrast, they observed a positive effect for farms where there was a higher proportion of low productivity meadows. Peerlings and Polman (2009) noted that beef farms were also less willing to adopt a landscape management scheme. In Ireland, producers with cattle, sheep and tillage farming systems were found to be more likely to enter an AES than dairy farmers (Hynes and Garvey, 2009). Capitanio *et al.* (2011) reported that, in general, the less a farm specialises in crop production (i.e. horticulture or permanent crops), and the more they specialise in livestock production, then the higher the probability of participation in an AES. A similar result was found by Wilson and Hart (2000), who noted that extensive grassland farms were more likely to adopt an AES than arable farms. For Alpine dairy farming, Marini *et al.* (2011) found that larger and more specialised farms may have an incentive to become involved in biodiversity conservation in order to halt current farmland biodiversity reduction. Also, in the case of livestock production in mountainous areas, Giupponi *et al.* (2006) recommended combining AESs with financial support for the adoption of new and appropriate technologies. Organic farms were more likely to adopt less intensive practices because they are already relatively extensive compared to conventional farms, but they were less likely to adopt landscape management measures (Peerlings and Polman, 2009).

Capitanio *et al.* (2011) found that the total quantity of fixed assets increased farmers' willingness to adopt an AES. Ducos *et al.* (2009) noted that machinery ownership might decrease participation by increasing the transaction costs associated with AES implementation. Similarly, Barreiro-Hurle et al. (2010) reported that farms that were more focused on cereal production, where there is often heavy investment in machinery, were less willing to adopt an AES.

4.3. Farmer's characteristics

Education, age and the presence of a successor are also among the explanatory variables used in the selected studies. Peerlings and Polman (2009) found that achieving medium or higher level education levels positively influenced farmers' willingness to adopt an AES focused on landscape management. Similarly, Wilson and Hart (2000) observed that EU farmers who have completed full-time education were more likely to be participants in AESs.

Defrancesco *et al*. (2008), however, found that higher levels of education were not linked to participation in an AES. Instead, their study identified a category of resistant non-adopters that consisted of a group whose failure to participate in an AES related neither to financial reasons nor to difficulties in implementing the required measures. They explained this result by pointing to the age of the sample of non-adopters, who tended to be younger than those farmers characterised as active participants in AES. Defrancesco *et al*. (2008) and Barreiro-Hurle *et al*. (2010) associated the likelihood of enrolment with the farming practices required for partipation in an AES, which in their cases were similar to those applied in more traditional low intensity farming systems and therefore more familiar to older farmers as well as being relatively easy to implement. The findings of Polman and Slagen (2008) and Peerlings and Polman (2009) did not support this conclusion. They noted that older farmers were, in fact, less likely to adopt an AES that required the introduction of less intensive practices. Hynes and Garvey (2009) and Capitanio *et al*. (2011) also reported that older farmers were less likely to adopt an AES. Younger and better educated farmers were also discovered to be more likely to adopt an AES in the studies by Mathijs (2003) and Barreiro-Hurle et al. (2010). Ruto and Garrod (2009) found than older farmers preferred longer contracts with higher payments per hectare. In addition, they did not find a significant link between farmers' education levels and their preferences for the duration of an AES contract.

Farmers' succession planning was revealed to have varying effects on their willingness to adopt an AES. Defrancesco *et al*. (2008) showed that the presence of a successor negatively affected the likelihood of participation in an AES. Similarly, it was found to reduce farmers' desire to adopt longer contracts (Ruto and Garrod, 2009) perhaps because many farmers prefer not to encumber their successors with a long-term contract? No significant effects around succession were found by Polman and Slagen (2008), Peerlings and Polman (2009) and Capitanio *et al*. (2011). Similarly, in cases where farmers have more positive expectations on the farms' future economic prospects they were less likely to adopt an AES (Defrancesco *et al*., 2008; Barreiro-Hurle et al., 2010). So, as suggested earlier, the economic position of the farm plays an important role in farmers' willingness to adopt an AES.

4.4. Farmer's attitudes to AES and environment

Berger *et al*. (2006) suggest that payments for engaging in nature conservation through an AES demonstrate a social acceptance of farmers' efforts to contribute to the supply of ecosystems services. Wilson and Hart (2000) reported that more conservation-oriented motivations for participation in an AES can play an important role in farmers' decision making processes around enrolment. Other research has also demonstrated that positive attitudes towards the environment, or to the adoption of environmentally-friendly farming practices, can play a significant part in farmers' willingness to participate in an AES (Defrancesco *et al*., 2008; Ruto and Garrod, 2009; Barreiro-Hurle *et al*., 2010). Dupraz *et al*. (2003) also pointed out that environmental awareness positively influences farmers' participation decisions, but they argue that this behaviour cannot be generalised, because in

some cases the willingness to adopt an AES is not a sign of altruistic behaviour, since farmers also receive utility (satisfaction) from the provision of public goods.

Barreiro-Hurle *et al*. (2010) noted that farmers who were more open to innovation or change were more willing to adopt measures where a new contractual arrangement is implied. Peerlings and Polman (2009) identified three characteristics of farmers that suggest an open-minded attitude towards landscape and wildlife, *i.e.* high levels of education, participation on non-agricultural activities, and trust in the government, and suggested that these characteristics may make farmers more willing to adopt an AES.

Farmers' experiences with past AESs and other environmentally-friendly farming practices has been shown in several studies to have a significant effects on farmers' willingness to adopt a new AES (Wilson and Hart, 2000; Ducos *et al*., 2009; Defrancesco *et al*., 2008; Hynes and Garvey, 2009). In addition, the easier it is to implement the required measures (i.e. the lower the cost of adoption), the more likely a farmers is to adopt an AES (Defrancesco *et al*., 2008; Ruto and Garrod, 2009; Barreiro-Hurle *et al.*, 2010; Niens and Marggraf, 2010). Peerlings and Polman (2009) noted that biodiversity conservation measures are generally considered to be relatively easy to implement on grassland, so beef and dairy farmers were more likely to participate in an AES. Similarly, Sattler and Nagel (2010) found that factors like associated risks, effectiveness, or the time and effort necessary to implement a particular measure could be equally, or even more, important than economic factors in explaining the decision to participate.

Farmers who felt that the financial compensation offered in an AES contract fully covered the associated costs of participation were more willing to join the scheme (Defrancesco *et al.*, 2008). Ruto and Garrod (2009) found that the per hectare payment methods used in most AESs may disproportionately benefit larger farms (who enjoy greater economies of scale and more opportunities to offset some of the opportunity costs of participation) compared to small farms, so willingness to adopt long-term contracts could increase as farms get larger. Espinosa-Goded *et al*. (2010) investigated farmers' preferences in cases where agri-environmental policy changes and discovered that farmers were willing to adopt an AES offering lower payments, as long as they could maintain their agricultural activities and did not face severe restrictions on farm management. Similar effects were observed relating to the flexibility of agri-environmental measures. If participation in a scheme forces farmers to change their farm activities and management, higher payments will positively affect their willingness to participate in AESs (Ruto and Garrod, 2009; Espinosa-Goded *et al*., 2010). Participation may also increase if payments are periodically adjusted in accordance with market prices (Niens and Marggraf, 2010).

4.5. Social capital

Farmers who have been well informed about a new scheme have been found to be more likely to participate, which means that making more information available on an AES (and therefore reducing the farmers' search costs), may increase overall participation (Wilson and Hart, 2000) and encourage existing members to renew their contracts (Morris, 2004). Important channels for obtaining information include technical advisors, extension, social and agriculture-related organisations, technical media, and government. At a more technical level, Bianchi *et al.* (2013) pointed out the lack of rigorous economic and agronomic analysis regarding the link between schemes and functional agrobiodiversity (i.e biodiversity at the scale of agricultural fields or landscapes, which provides ecosystem services that support sustainable agricultural production) may reduce participation in agri-environmental measures.

Defrancesco *et al.* (2008) described the important role played by the opinions and experiences of neighbouring farmers regarding AESs in influencing new entrants' willingness

to enrol in a scheme. They suggested that the influence exerted by neighbouring farmers reflects the strong relationships and cultural norms that exists in many rural areas. Similarly, the work of Burton (2004), Burton and Paragahawewa (2011) and Emery and Franks (2012) suggested that some farmers are conscious of the possibility of exposure to the judgement and criticism of their peers, if their activities do not reflect the cultural norms or expectations of their neighbours. This fear can have the negative effect of fostering a lack of communication or mutual understanding between neighbouring farmers (Emery and Franks, 2012) and may reduce farmers' access to local social capital (Burton and Paragahawewa, 2011), thus decreasing their likelihood of joining an AES, particularly those that require the participation of several farmers at a landscape scale (Emery and Franks, 2012). Sattler and Nagel (2010), however, downplay the significance of the opinions of other farmers when a farmer decides to adopt a new measure.

In general, the use of technical advice or extension services is found to play a positive role in farmers' willingness to adopt an AES. Furthermore, technical advice can have an important positive impact on farmers' willingness to adopt an AES in cases where policy changes lead to either lower payments (Espinosa-Goded *et al*., 2010) or to the application of new measures (Niens and Marggraf, 2010). Similarly, farmers who read the farming press have been found to be more likely to adopt an AES (Defrancesco *et al*., 2008; Mathijs, 2003).

Advice from public and private extension services has also been found to encourage farmers to join an AES (Polman and Slagen, 2008; Mathijs, 2003; Barreiro-Hurle *et al*., 2010). Peerlings and Polman (2009) revealed that public extension services can have a negative impact on farmers' willingness to adopt a scheme focusing on landscape management, but a positive effect when they concentrate on biodiversity conservation and the implementation of less intensive practices. Giupponi *et al.* (2006) highlighted the importance of agri-environmental measures to mitigate situations of vulnerability for biodiversity as an effect of climate change. Peerlings and Polman (2009) associated the use of public extension services and participation in agriculture-related organisations to "conservative" farmers who are more resistant to change.

Polman and Slagen (2008) and Peerlings and Polman (2009) all found that private extension services had a negative effect on farmers' willingness to join an AES that requires the adoption of less intensive practices. Conversely, Barreiro-Hurle *et al.* (2010) reported the positive impact of private advisers and financial entities in promoting both low and high intensity measures. These differences can be explained through reference to Sutherland *et al*. (2013), who noted the relationship between farmers' production criteria (i.e. conventional or environmental-oriented farming) and the type of advisory services that they seek.

In general, social networks and organisations are an important catalyst for farmer behaviour (Polman and Slagen, 2008; Mathijs, 2003; Capitanio *et al*., 2011; Beckmann *et al.*, 2009; Peerlings and Polman, 2009). The role of agriculture-related organisations is not found to be homogeneous in the selected studies. These organisations have a negative effect on willingness to adopt an AES based on landscape maintenance or which restrict intensive practices (Polman and Slagen, 2008; Peerlings and Polman, 2009). By contrast, Capitanio *et al.* (2011) argued that participation in agriculture-related cooperatives encourages farmers to join an AES. Agriculture-related organisations could play an important role in policy design, because they provide useful information to support this process, reducing public transaction costs, and also potentially making the proposed AES more acceptable for farmers by stimulating a greater level of trust in the final scheme design (Mettepenningen, *et al*., 2013). Interestingly, in their study on the design of AESs, Beckmann *et al.* (2009) found that there was opposition among policy makers to extend participation in decision-making on AES design to the local level and to other relevant environmental associations.

The approach used by governments to implement AESs in rural areas across the EU has also been identified as an important variable. Ducos *et al*. (2009) found that farmers expected mutual benefits to be generated through their adoption of AESs, and if they trusted the government, then their willingness to participate was found to increase. By contrast, Polman and Slagen (2008) believed that, in general, trust had little or no effect on participation. In a later study, Peerlings and Polman (2009), however, observed that trust in government could have a positive effect on farmers' willingness to adopt an AES. High quality messages and high levels of institutional trust, along with a trusted individual to communicate the message (e.g. a farm advisor), could be the best way to aid the uptake of a new scheme (Sutherland *et al*., 2013). Trust increases when AESs stimulate the positive externalities of farming, and at the same time reduce associated monitoring and control costs (Mettepenningen *et al*., 2013)

Finally, a clear institutional design and a stable policy for future periods can reduce farmers' resistance to adopting an AES (Defrancesco *et al*., 2008; Polman and Slagen, 2008 and Peerlings and Polman, 2009), especially in cases where there is uncertainty about the possible introduction of more restrictive alternatives or mandatory policies (Defrancesco *et al*., 2008). In this sense, Ruto and Garrod (2009) note that most farmers would prefer AESs to be less restrictive and more flexible over the land to be included and the management practices that have to be adopted. Social and agriculture-related organisations, as well farmers' opinions should be canvassed to inform policy design to achieve a greater likelihood of the adoption of an AES. Whittingham (2008), Prager and Freese (2009) and Niens and Marggraf (2010) all stress that stakeholder participation is a key tool for policy design and decision-making where the objective is to increase farmers' willingness to participate in an AES.

5. Conclusions

Despite the heterogeneity of findings in the selected studies, some influential drivers can be identified as key factors when designing agri-environmental policy measures. Among economic factors, farmers who are most dependent on farm income are found to be less likely to join an AES. Similarly, farms that involve a high proportion of family labour also exhibit a lower likelihood of participating in a scheme. Policies that reduce farm households dependence on on-farm income could therefore have the externality benefit of bringing more farms into AESs.

The effects of farm size on adoption yields varied results across studies, but in general there is agreement that larger farms find it easier to adopt less intensive measures and may therefore find it easier to participate in an AES. The heterogeneity in results can be explained by the lack of consistency in ways in which farms are defined as "large" or "small", which is in itself partly due to the discrepancy in average farm size across EU member states. Farms located in areas with lower agricultural capacity are more likely to adopt an AES. Commonly, the schemes are seen as an additional source of income for the farm that helps to compensate for the lower productivity of the land and offset some of the risks associated with agricultural production.

The presence of a successor on a farm generally has a negative effect on the farmers' willingness to adopt an AES, as farmers are unwilling to agree to a restrictive long-term contract that may extend beyond their period of stewardship for the farm. This driver can be seen as an opportunity for policy-makers to encourage a greater involvement of the successor in the decision-making process or to design new policies where the contracts could be modified or withdrawn in the case of a change of management. This added flexibility could encourage farmers to participate in schemes that offer longer contract lengths which otherwise might be less attractive to them.

Previous experiences with AESs positively affect farmers' willingness to adopt an AES. This may reflect their greater trust in a familiar policy instrument or their confidence in being able to play the system in their favour and profit from the associated payments. This driver is more important when is related to the observation that neighbouring farmers' experiences and opinions about AESs can influence farmers' behaviour. So, policy makers could take advantage of this group of farmers to act as advocates for or champions of the benefits of the AES participation. Moreover, the social capital of rural areas could be enhanced if farmers were required to work together in AESs at a landscape scale that would also benefit biodiversity. A further finding is that a positive attitude towards the environment can be reinforced through the introduction of measures such as improved knowledge exchange mechanisms, which succeed in demonstrating the links between good management and the delivery of ecosystem services. In this way, future generations of farmers could be encouraged into a greater willingness to adopt the practices promoted under AESs. In addition, active participation by farmers who are more deeply committed to delivering the management outcomes promoted by schemes should further improve the effectiveness of agri-environment measures.

As an important source of income, the level of payment offered by a scheme is one of the most important drivers for farmers to adopt an AES. Many farmers would consider fair payments and lower levels of disruption to their normal agricultural activities, as an acceptable alternative to higher payments requiring greater changes to their farming systems. A more flexible approach to the design of AESs, permitting the incremental adoption of measures across different scheme phases of increasing intensity with associated increases in payment levels could play an important role in increasing farmers' willingness to join an AES and adopt more novel practices (e.g. landscape scale management measures in conjunction with other neighbouring farmers) that could deliver greater levels of environmental benefit.

Promotion of local social capital has been seen as a key factor to increase farmers' willingness to adopt an AES in many of the selected studies. Extension services, both public and private, play an important role in promoting the adoption of AESs, so advisers should not only be seen as key actors in the promotion of AESs, but have the opportunity to receive appropriate training about new agri-environmental policies. Something similar would be required for relevant social and agriculture-related organisations. Workshops and other activities could be included as part of the package of measures used to promote the benefits of AESs to these influential groups.

One shortcoming of many of the papers considered here is that they offer relatively little guidance on how schemes can be designed to improve the environmental effectiveness of AESs. Whittingham (2011), in a review of 13 papers evaluating the environmental performance of AESs, reported that there are signs that management options targeted spatially within the landscape and implemented with careful advice can deliver substantial biodiversity benefits. In terms of good practice, Whittingham goes on to argue that in order to ensure that schemes are effective, it is crucial that farmers and land managers are included in the design of the schemes to ensure the better participation and engagement of farmers. He provides the example of the unpopularity among farmers of AES options in England that require them to manage land within the crop itself (Whittingham, 2011).

Finally, on the issue of methodology, the studies selected in this review take a particularly quantitative route to investigating the factors that influence farmers to join an AES. While such approaches have been shown to yield a variety of useful insights, the adoption of mixed methods approaches where quantitative data are supplemented by qualitative methods may yield even richer information about farmers' motives and preferences for participating in AESs. Mixed methods approaches combining qualitative and quantitative data are commonly used to investigate a range of farm level decisions, such as conversion from

conventional to organic agriculture (e.g. Burton et al., 1999; Lapple and Kelley, 2013). In some cases qualitative data may inform the design of the quantitative element of the study, while in others the qualitative data may complement a quantitative data modeling exercise by providing further insights into the behaviours and attitudes that underpin its findings.

Taken together, the findings synthesised from the studies covered here provide valuable guidance for policy makers designing agricultural and rural policy. Overall, a better understanding of the motivations of farmers and of how changes in scheme design can either encourage or discourage active participation in schemes, is a crucial requirement when designing the next generation of AESs. From a broader perspective, however, it is also important to realise that other policies which impact on the farm household and the rural community can also influence participation in an AES and this should not be ignored when considering the direction of future agricultural and rural development policy.

Acknowledgements

The authors are very grateful to Andalusia Regional Government (Consejería de Economía, Innovación y Ciencia), Spain, for financing this work through the Programme "Formación de personal docente e investigador predoctoral en las Universidades Andaluzas, en áreas de conocimiento deficitarias por necesidades docentes (FPDU 2008)". This is a programme co-financed by the European Union through the European Regional Development Fund (ERDF).

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